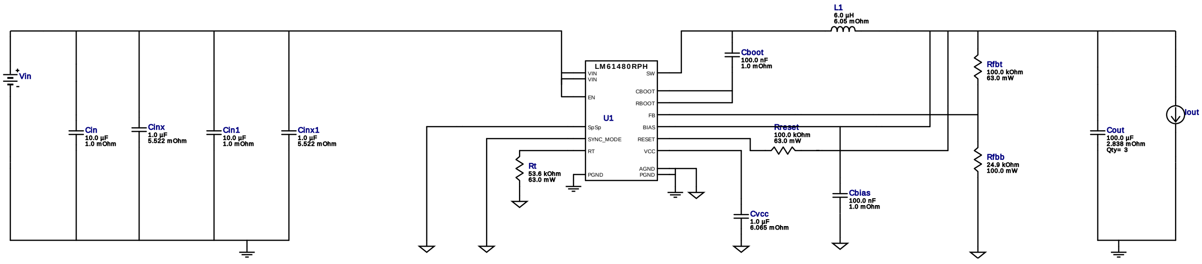
TEXAS INSTRUMENTS

VinMin = 14.0V
VinMax = 25.2V
Vout = 5.0V
Iout = 6.0A

Device = LM61480RPHR
Topology = Buck
Created = 2025-07-04 15:12:08.542
BOM Cost = $5.00
BOM Count = 16
Total Pd = 1.04W

WEBENCH ® Design Report

Design : 32 LM61480RPHR
LM61480RPHR 14V-25.2V to 5.00V @ 6A

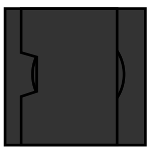


Design Alerts

Component Selection Information

This device can work in steady state at Vin = 3V. However, needs a minimum of 3.6V during start up. See datasheet for details.

Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbias	MuRata	GRM155R71C104KA88D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
Cboot	MuRata	GRM155R71A104KA01D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
Cin	MuRata	GRM32ER71H106KA12L Series= X7R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 6.0 A	1	$0.47	1210_270 15 mm²
Cin1	MuRata	GRM32ER71H106KA12L Series= X7R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 6.0 A	1	$0.47	1210_270 15 mm²
Cinx	TDK	C1608X5R1H105K080AB Series= X5R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 50.0 V IRMS= 2.2162 A	1	$0.03	0603 5 mm²
Cinx1	TDK	C1608X5R1H105K080AB Series= X5R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 50.0 V IRMS= 2.2162 A	1	$0.03	0603 5 mm²
Cout	TDK	C3216X5R1A107M160AC Series= X5R	Cap= 100.0 uF ESR= 2.838 mOhm VDC= 10.0 V IRMS= 4.3069 A	3	$0.46	1206_190 11 mm²
Cvcc	MuRata	GRM188R60J105KA01D Series= X5R	Cap= 1.0 uF ESR= 6.065 mOhm VDC= 6.3 V IRMS= 1.36934 A	1	$0.01	0603 5 mm²
L1	Coilcraft	SER1360-602KLB	L= 6.0 µH 6.05 mOhm	1	$0.74	 SER1360 225 mm²

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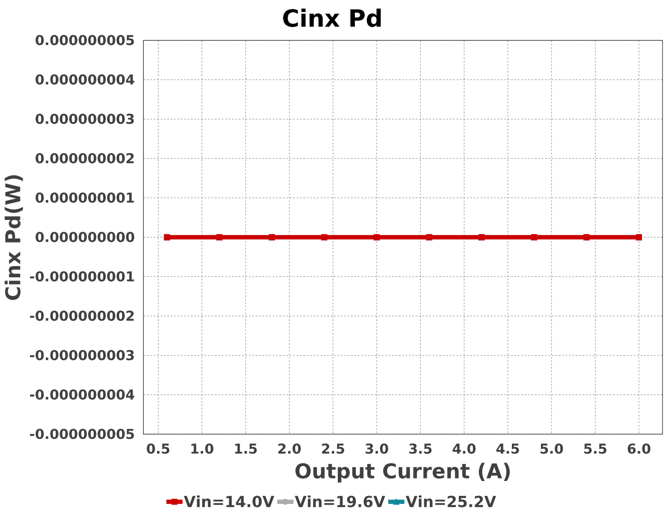
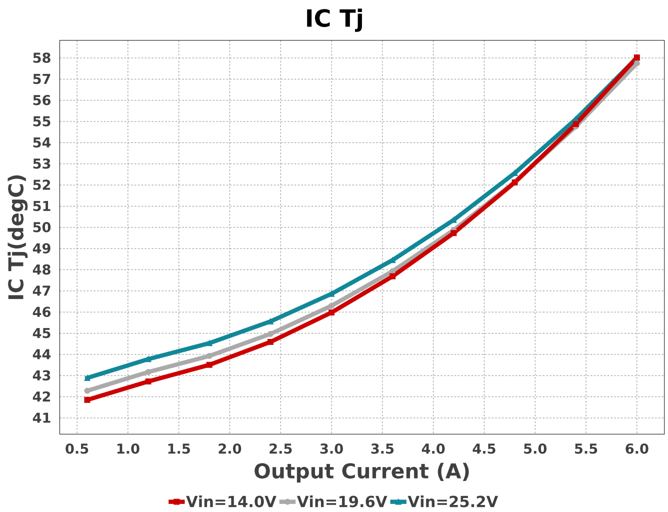
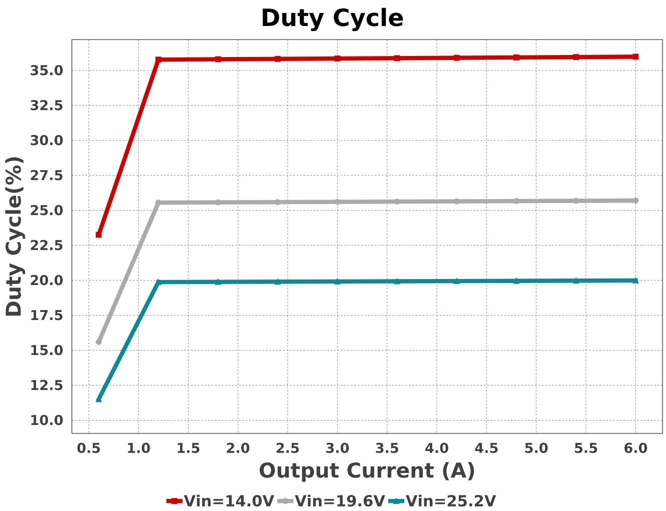
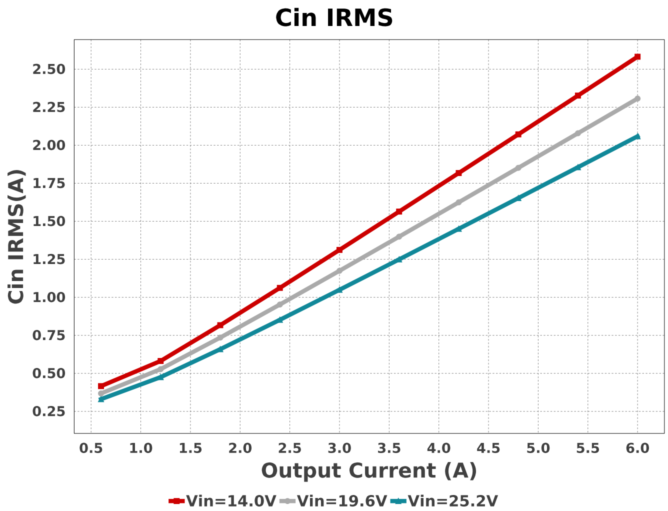
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rfbb	Yageo	RC0603FR-0724K9L Series= ?	Res= 24.9 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
Rfbt	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rreset	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rt	Vishay-Dale	CRCW040253K6FKED Series= CRCW..e3	Res= 53.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
U1	Texas Instruments	LM61480RPHR	Switcher	1	$1.81	RPH0016A 25 mm²









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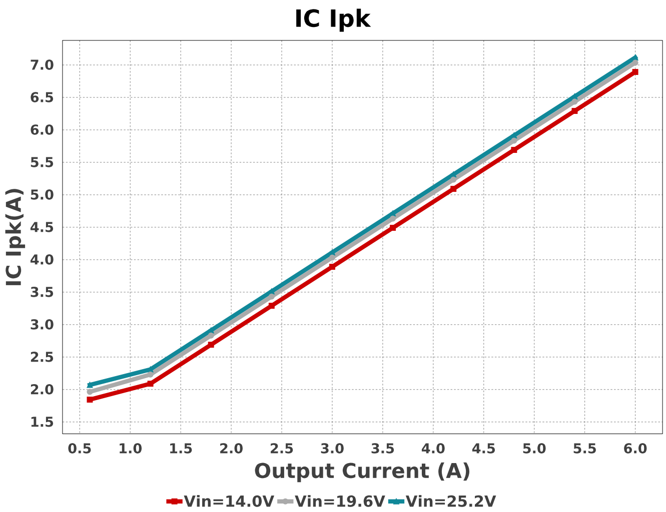
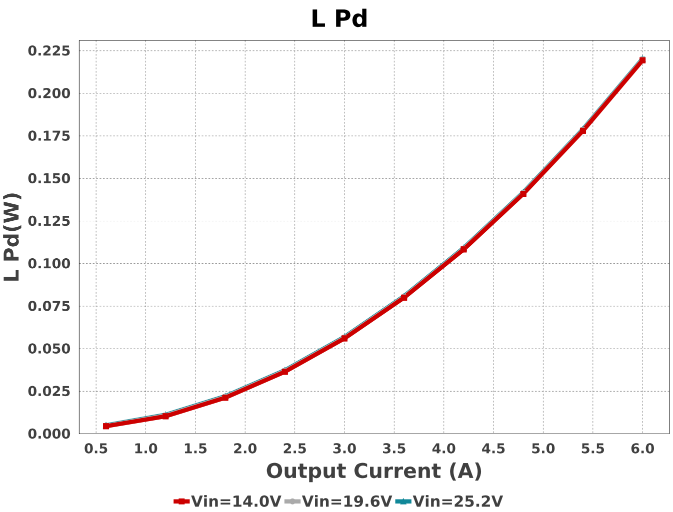
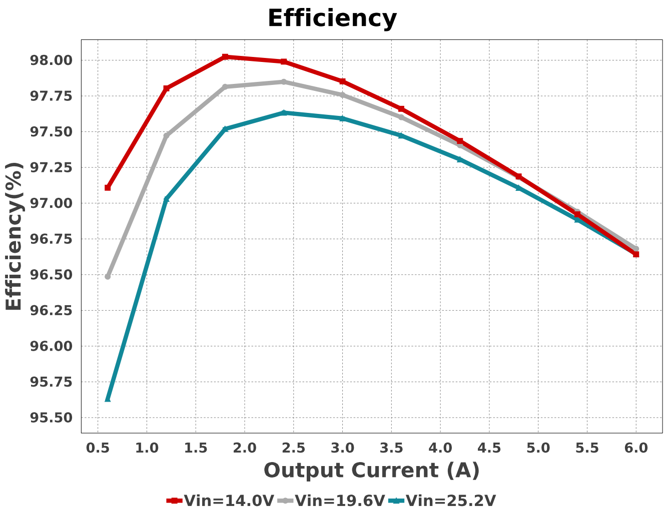
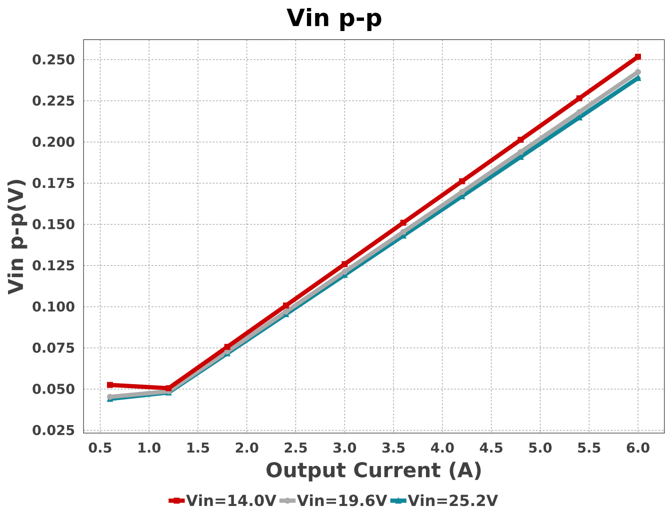
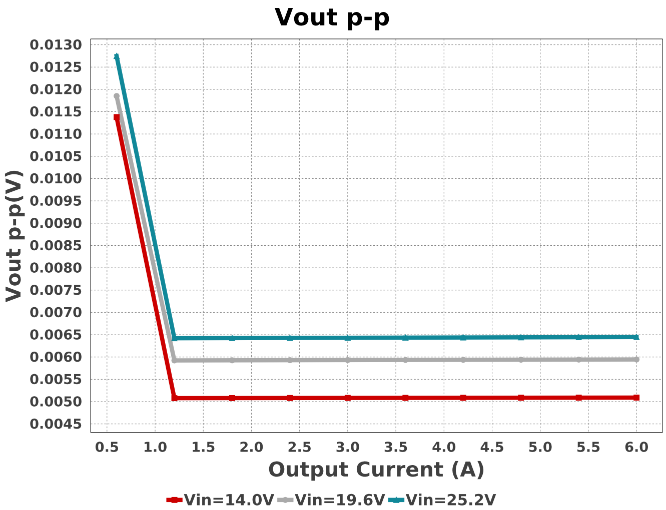
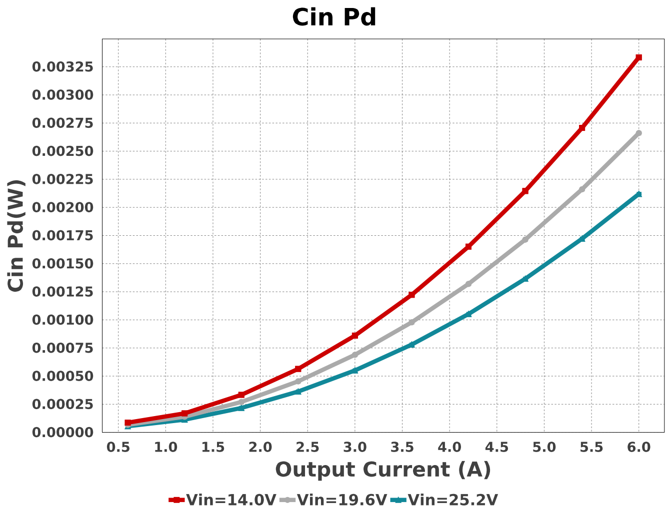

IC Ipk
IC Ipk(A)
Output Current (A)
Vin=14.0V Vin=19.6V Vin=25.2V


L Pd
L Pd(W)
Output Current (A)
Vin=14.0V Vin=19.6V Vin=25.2V

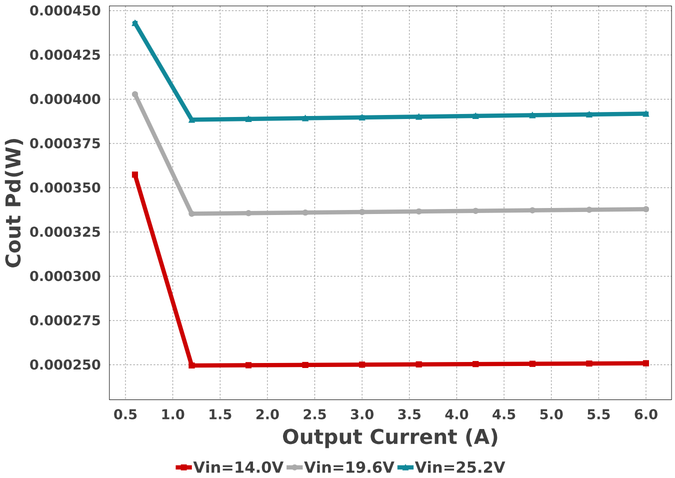

Efficiency
Efficiency(%)
Output Current (A)
Vin=14.0V Vin=19.6V Vin=25.2V


Vin p-p
Vin p-p(V)
Output Current (A)
Vin=14.0V Vin=19.6V Vin=25.2V

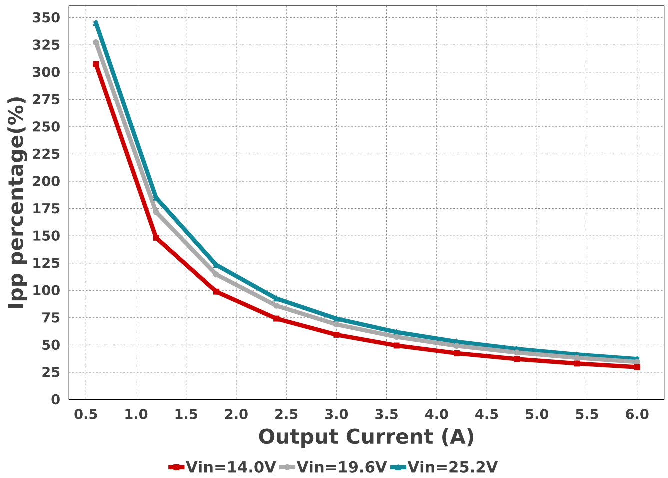

Vout p-p
Vout p-p(V)
Output Current (A)
Vin=14.0V Vin=19.6V Vin=25.2V


Cin Pd
Cin Pd(W)
Output Current (A)
Vin=14.0V Vin=19.6V Vin=25.2V

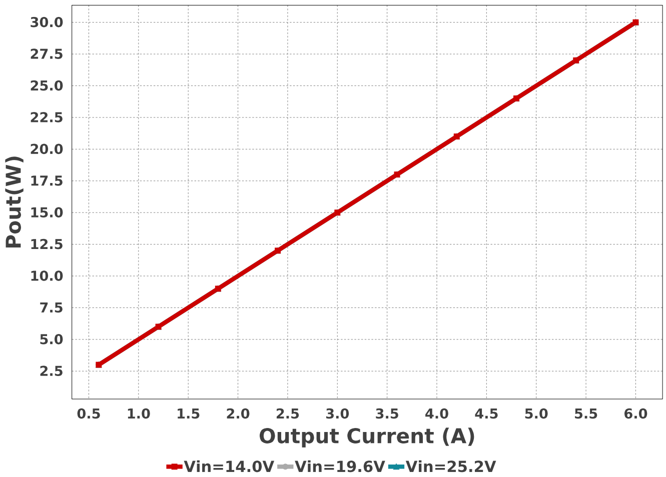
Cout Pd



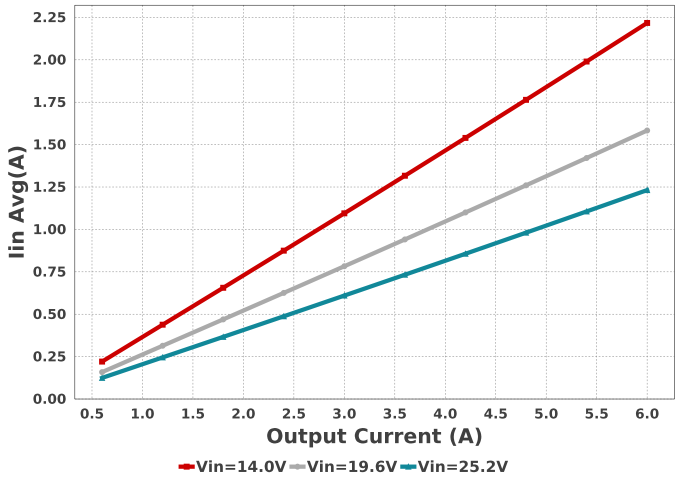
Ipp percentage



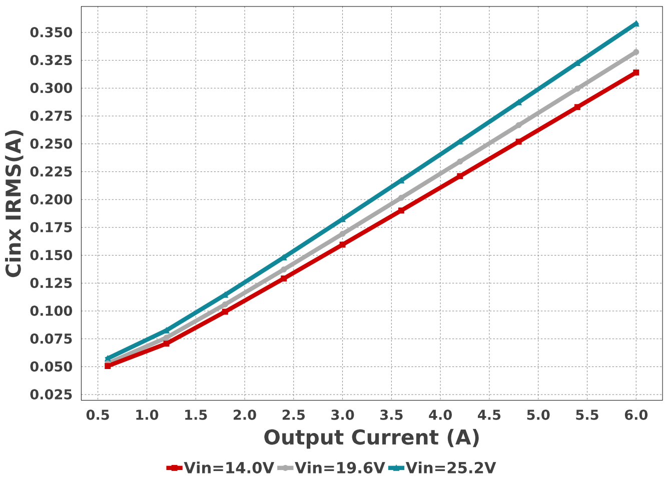
Pout



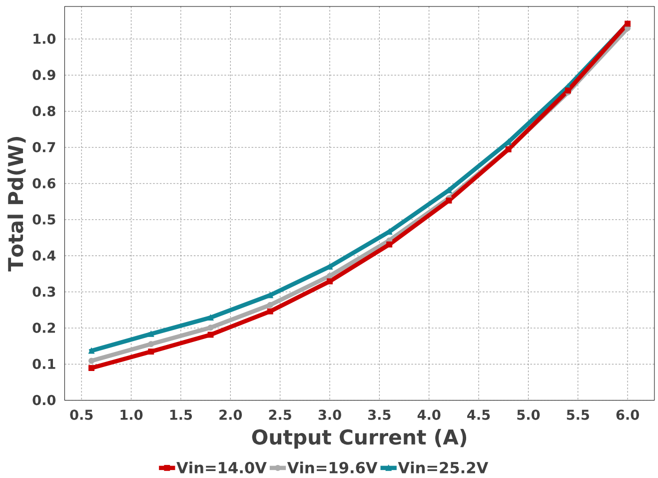
Iin Avg



Cinx IRMS



Total Pd



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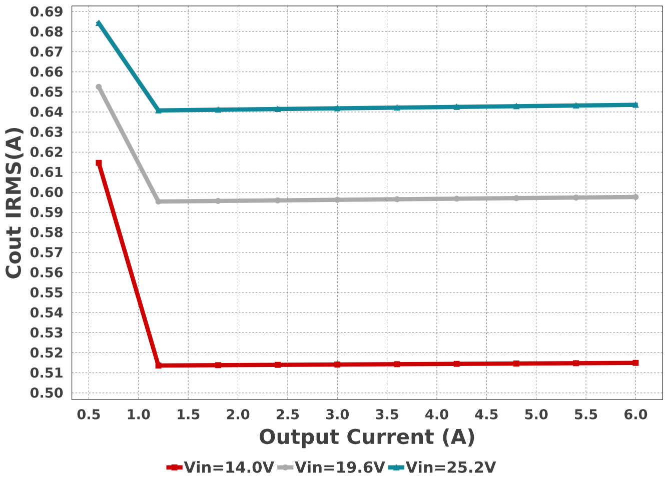

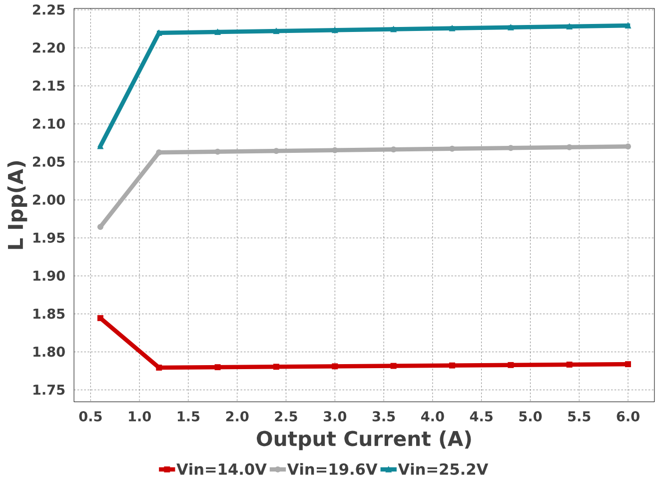

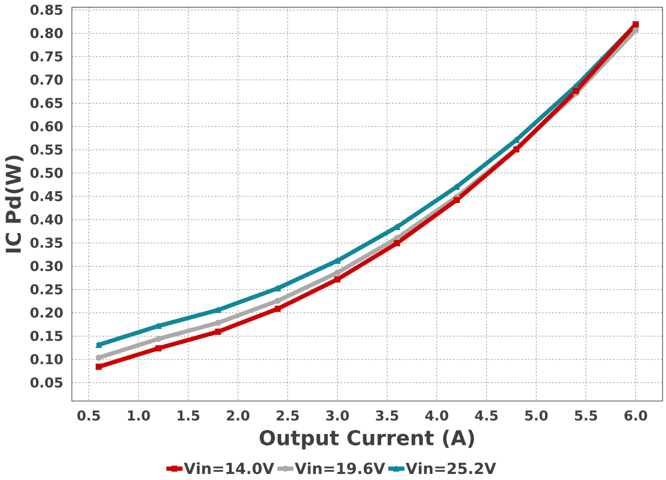

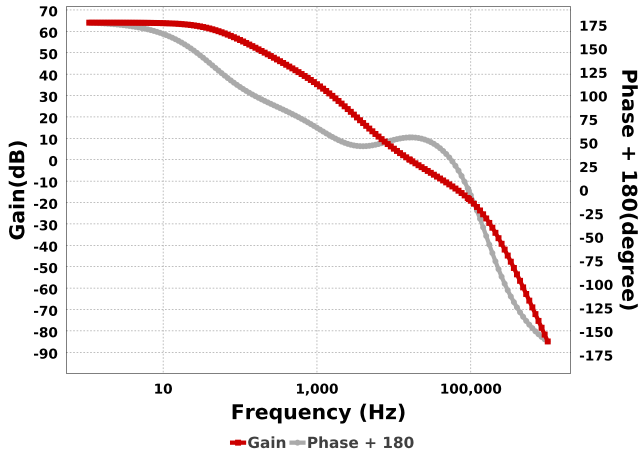

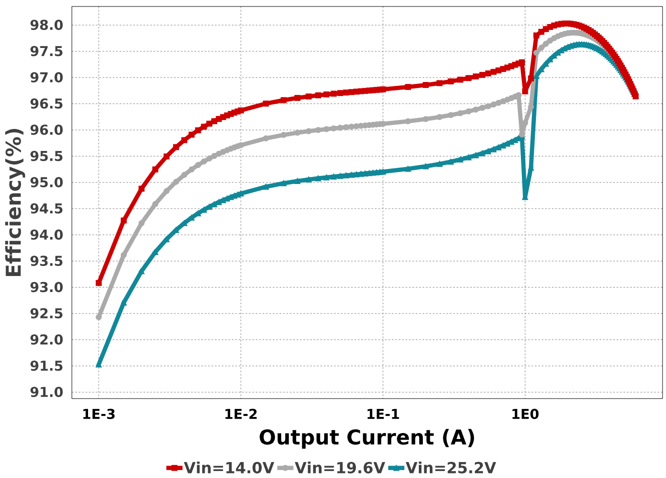

Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.059 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	2.119 mW	Capacitor	Input capacitor power dissipation
3.	Cinx IRMS	357.929 mA	Capacitor	Bulk capacitor RMS ripple current
4.	Cinx Pd	0.0 W	Capacitor	Bulk capacitor power dissipation
5.	Cout IRMS	643.571 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	391.82 µW	Capacitor	Output capacitor power dissipation
7.	IC Ipk	7.115 A	IC	Peak switch current in IC
8.	IC Pd	818.57 mW	IC	IC power dissipation
9.	IC Tj	58.008 degC	IC	IC junction temperature
10.	ICThetaJA Effective	22.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
11.	Iin Avg	1.232 A	IC	Average input current

#	Name	Value	Category	Description
12.	Ipp percentage	37.157 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
13.	L Ipp	2.229 A	Inductor	Peak-to-peak inductor ripple current
14.	L Pd	220.31 mW	Inductor	Inductor power dissipation
15.	Cin Pd	2.119 mW	Power	Input capacitor power dissipation
16.	Cinx Pd	0.0 W	Power	Bulk capacitor power dissipation
17.	Cout Pd	391.82 µW	Power	Output capacitor power dissipation
18.	IC Pd	818.57 mW	Power	IC power dissipation
19.	L Pd	220.31 mW	Power	Inductor power dissipation
20.	Total Pd	1.041 W	Power	Total Power Dissipation
21.	BOM Count	16	System Information	Total Design BOM count
22.	Cross Freq	16.137 kHz	System Information	Bode plot crossover frequency
23.	Duty Cycle	19.988 %	System Information	Duty cycle
24.	Efficiency	96.645 %	System Information	Steady state efficiency
25.	FootPrint	346.0 mm^2	System Information	Total Foot Print Area of BOM components
26.	Frequency	301.309 kHz	System Information	Switching frequency
27.	Gain Marg	-18.373 dB	System Information	Bode Plot Gain Margin
28.	Iout	6.0 A	System Information	Iout operating point
29.	Low Freq Gain	64.062 dB	System Information	Gain at 1Hz
30.	Mode	CCM	System Information	Conduction Mode
31.	Phase Marg	56.724 deg	System Information	Bode Plot Phase Margin
32.	Pout	30.0 W	System Information	Total output power
33.	Total BOM	$5.0	System Information	Total BOM Cost
34.	Vin	25.2 V	System Information	Vin operating point
35.	Vin p-p	238.859 mV	System Information	Peak-to-peak input voltage
36.	Vout	5.0 V	System Information	Operational Output Voltage
37.	Vout Actual	5.016 V	System Information	Vout Actual calculated based on selected voltage divider resistors
38.	Vout Tolerance	2.634 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
39.	Vout p-p	6.448 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	6.0	Maximum Output Current
VinMax	25.2	Maximum input voltage
VinMin	14.0	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	LM61480	Base Product Number
source	DC	Input Source Type
Ta	40.0	Ambient temperature

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WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of Cin and Cout, and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

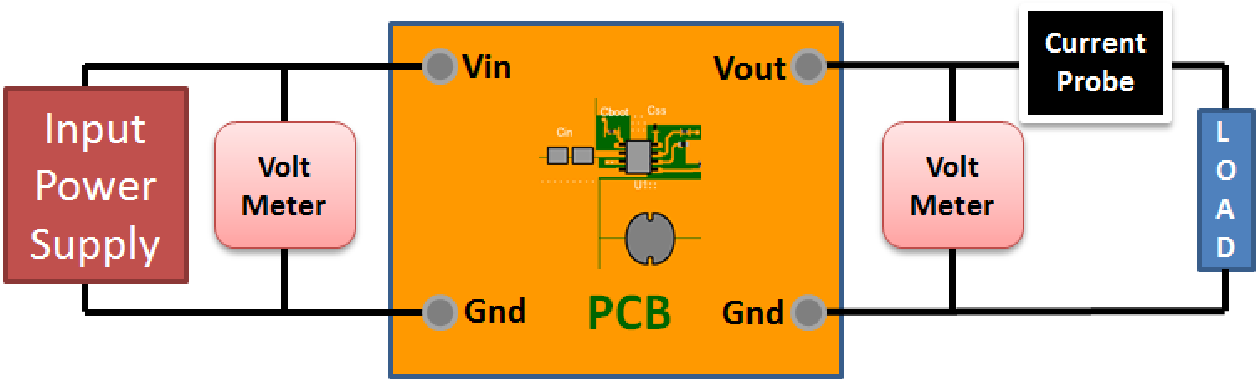
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 14.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to Vin and GND. Connect a digital volt meter and a load if needed to set the minimum Iout of the design from Vout and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between Vin and GND, a load is connected between Vout and GND and a current meter is connected in series between Vout and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.

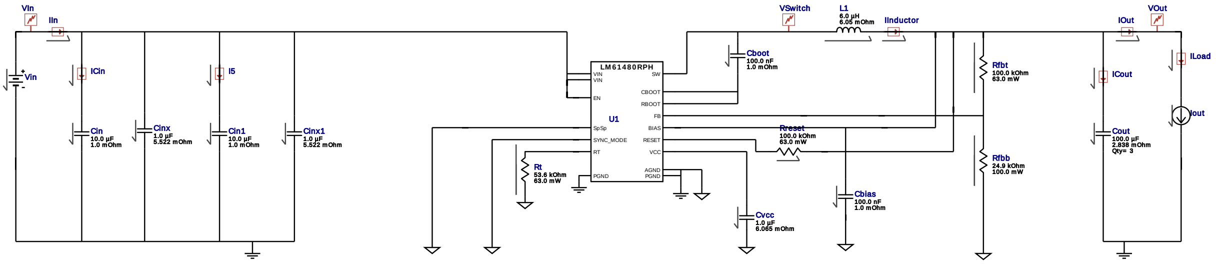


WEBENCH® Electrical Simulation Report

Design Id = 32

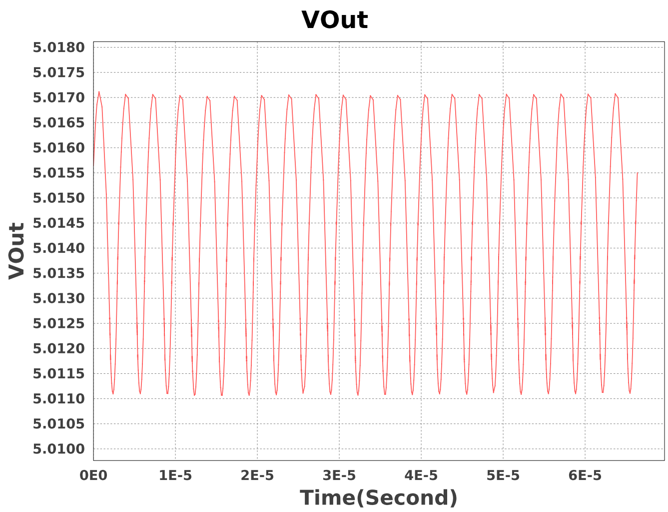
sim_id = 1

Simulation Type = Steady State



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	L1	IC	Initial Current	6.0 A
2.	Iout	I	Output Current	6.0 A



Design Assistance

1. The LM61480 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. This device can work in steady state at Vin = 3V. However, needs a minimum of 3.6V during start up. See datasheet for details The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application

2. Master key : 037148F0F28CF213889588473A742D0A[v1]

3. **LM61480** Product Folder : http://www.ti.com/product/LM61480 : contains the data sheet and other resources.

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